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ABSTRACT

A two-phase project was initiated to establish a research base of needed information technology skills. Phase 1 identified and verified the technical, human, and conceptual skills needed by clerical, managerial, and professional personnel to use information technology effectively. Phase 2 was the national validation of such skills through descriptive survey research. Survey instruments were mailed to 360 clerical, managerial, and professional personnel; 195 respondents ranked the importance of skills. Two hundred thirty-three teachers also responded to the three survey instruments. Of the top-ranked information technology skills needed by clerical personnel, five were technical, four were human, and one was conceptual. Of the top-ranked information technology skills needed by managerial personnel, five were human, four were conceptual, and two were technical. Of the top-ranked information technology skills needed by professional personnel, six were human, three were technical, and one was conceptual. The hypothesis that there were no significant differences in employee and teacher perceptions of information technology skills was rejected for 13 of the top-ranked information technology skills for the three categories of personnel. (Selected highlights of the data analysis are presented, including overviews of the top-ranked skills for each employee classification and demographic variable data.) (YLB)

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SKILLS NEEDED BY INFORMATION TECHNOLOGY USERS

By

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INTRODUCTION

Information technology is of increasing importance. Business and industry find it important in that ". . .five out of 10 jobs are information jobs; in the next two decades seven out of 10 jobs may fall into the information category" (Weinstein, 1983, p. 4).

Well-defined office systems programs must be provided if students are to receive training which will enable them to acquire technical, human, and conceptual skills needed to assume clerical, managerial, and professional roles involving the use of information technology. It is imperative that necessary skills be identified before they can be developed in a systematic manner.

In an attempt to establish a research base of needed information technology skills, the researchers initiated a two-phase project. Project I, consisting of skill identification and verification was completed in fall 1982. Phase II involved the national validation of skills identified and verified in Phase I.

NEED FOR THE STUDY

Educators are interested in information technology because they are expected to provide leadership in preparing primary information technology users such as clerical, managerial, and professional personnel. However, the evolution of information technology has occurred so rapidly that education and educators have had difficulty in keeping pace, much less serving in a leadership capacity.

A comprehensive computer-assisted search of business, psychological, and educational periodicals and dissertation abstracts was conducted in the spring of 1982. A subsequent review of related literature

revealed that research has been completed concerning many of the technical skills needed by clerical and managerial personnel who engage in the processing of information. However, attention had not been focused on human and conceptual skills which are also needed. Another area in need of research was that of skills needed by professional personnel who originated information which is processed within an organization.

Well-defined office systems programs must be provided if students in educational or employment situations are to receive training which will enable them to acquire technical, human, and conceptual skills needed to assume clerical, managerial, and professional roles involving the use of information technology.

OBJECTIVES

A two-phase project was initiated to address the development of well-defined office systems programs.

The major objective of Phase I was to identify the technical, human, and conceptual skills needed by clerical, managerial, and professional personnel to utilize effectively information technology. Phase II of the project--the validation of such skills--would (a) provide inputs necessary to the evaluation of existing collegiate curricular programs in office systems and (b) establish a research base for the development of appropriate, more timely collegiate office systems programs.

Secondary purposes were to (a) compare perceptions of collegiate teachers of office systems with perceptions of clerical, managerial, and professional personnel who use information technology and (b) develop profiles of contemporary clerical, managerial, and professional personnel who use information technology.

HYPOTHESES

The hypotheses of the study were as follows:

1. There are no significant differences in employee and teacher perceptions of information technology skills.

2. There are no significant differences among employee perceptions of information technology skills, as based upon selected demographic data.

ASSUMPTIONS

For the purpose of this project, the following assumptions were made:

1. Technical, human, and conceptual skills needed by clerical, managerial, and professional personnel who utilize information technology are identifiable and provide a base for the planning of meaningful, appropriate office systems curricula.

2. Clerical, managerial, and professional employees are qualified to validate skills which employees in their respective classifications need to perform successfully on the job.

3. The survey method is a valid method for ascertaining employee perceptions of the skills they need to successfully fill their roles.

4. The use of a Likert-type scale is recognized as an appropriate means for assessing employee perceptions of importance associated with identified skills.

The basic limitation of the project was that validated technical, human, and conceptual skills are needed only by clerical, managerial, and professional personnel who use information technology.

DEFINITION OF TERMS

The terms used in the project are defined here for clarification.

Clerical personnel. Clerical personnel refers to employees who keyboard, reproduce, file, and distribute information using electronic equipment.

Collegiate office systems instructors. National Association of Business Teacher Education institution instructors teach business education courses in information technology and/or office systems.

Technical skill. Technical skill refers to ability to operate information processing equipment.

Human skill. Human skill refers to ability to communicate and relate interpersonally.

Conceptual skill. Conceptual skill refers to ability to express, interpret, problem solve, or make decisions involving abstract ideas generalized from specifics.

Information technology. Information technology refers to the electronic methods or means for processing communcation.

Managerial personnel. Managerial personnel refers to employees who supervise and coordinate clerical workers in a company's information technology center.

Professional personnel. Professional personnel refers to employees who originate information processed on electronic equipment.

METHODOLOGY

The design of Phase II of the study was basically descriptive survey research. The major purpose of Phase II was to validate the skills identified and verified in Phase I. The skills were identified

via a comprehensive literature review and verified via interviews with 56 clerical, managerial, and professional employees who use information technology in their jobs with Fortune 500 companies based in metropolitan Atlanta.

The interview guides used in Phase I were adapted for use as mail survey instruments for Phase II. The final instruments, the "Clerical Personnel Survey Instrument," the "Managerial Personnel Survey Instrument," and the "Professional Personnel Survey Instrument," each included technical, human, and conceptual skills germane to the particular employee classification. Each instrument included a Likert-type scale of five levels to determine the importance of the various skills. The five levels and their respective nomenclatures are as follows: 5, of extreme importance; 4, of above average importance; 3, of average importance; 2, of below average importance; and 1 of no importance. Demographic questions were included in the three instruments so that profiles of contemporary clerical, managerial, and professional employees who use information technology could be obtained.

Samples of the three employee classifications were selected from Fortune 500 companies nationally. A letter was sent to the personnel officer of each of the 217 sample companies requesting that they assist the researchers in two ways--to serve as the company contact person for the project and to provide a listing of how many clerical, managerial, and professional employees use information technology at the corporate-office level. Responses were received from 104 companies. Affirmative responses were received from 40 companies; 64 companies preferred not to participate, and no response was received from 113 companies. A systematically-selected proportional number of employees in each

classification were identified as potential participants from each of the 40 companies. A total of 360 potential employee participants were selected--120 clerical employees, 120 managerial employees, and 120 professional employees.

Seventy-two (60 percent) of the clerical employee participants supplied completed copies of the "Clerical Personnel Survey Instrument." Fifty (42 percent) of the managerial employee participants completed copies of "Managerial Personnel Survey Instrument," and 73 (61 percent) of the professional employee participants supplied completed copies of the "Professonal Personnel Survey Instrument."

The teacher population for Phase II consisted of National Association of Business Teacher Education (NABTE) institution teachers who teach business education courses in which hands-on experience is obtained in the use of information technology equipment. A sample of teachers from 163 NABTE institutions was selected for Phase II. Department heads at the sample institutions were contacted requesting that they serve as contact persons for the project and that they provide a listing of appropriate teachers to participate in the project. Three hundred sixty-one potential teacher participants were identified from 123 institutions. The 361 were randomly divided into three groups so that 120 were selected to respond to the "Clerical Personnel Survey Instrument," 120 were asked to respond to the "Managerial Personnel Survey Instrument," and 121 were asked to respond to the Professional Personnel Survey Instrument." Seventy teachers (58 percent) furnished completed copies of the clerical instrument, 77 teachers (64 percent) completed the managerial instrument, and 86 teachers (72 percent) completed the professional instrument.

Data gathered from the employee and teacher samples were computer processed. Although the responses to skill statements were basically ordinal-level data, they were sufficiently great in number to have random errors cancel and be treated with parametric tests.

The level of significance was set at .05 from the outset of the research project. Independent t-tests were conducted to test significant differences among employee and teacher perceptions as to the importance of skills grouped in the technical, human, and conceptual clusters. The separate rather than the pooled variance was used whenever scores failed to meet the assumption of homogeneity of variances.

Independent t-tests and one-way analysis of variance were used to test for differences among employee perceptions of skills grouped in clusters based on selected demographic variables. Homogeniety of variances was tested using Bartlett's chi square test. Scheffe was used as the a posteriori test to determine where significant differences existed.

An employee skill mean score of 4.0 was interpreted by the researchers as indicating that a skill is of considerable importance in an employee's performing his/her information technology related duties.

Selected highlights of the data analysis including overviews of the top-ranked skills for each employee classification and demographic variable data are presented as part of this paper.

ANALYSIS OF THE DATA

Data presented in this section appear in the following order: Top-Ranked Information Technology Skills--Clerical, Managerial, and Professional, Clerical Personnel Demographic Data, Managerial Personnel

Demographic Data, and Professional Personnel Demographic Data.

Top-Ranked Information Technology Skills

Clerical. Table 1 shows the top-ranked information technology skills needed by clerical personnel as rated by clerical employees and teachers. The skill receiving the highest mean importance rating was Technical Skill Number 16 (T16), "Follow instructions." The employee mean importance rating for T16 was 4.7183, and the teacher mean importance rating was 4.9000. Significant difference at the .05 level was found for T16 which had a t-value of -2.2329. Significant difference was also found for Human Skill Number 1 (H1), "Listen effectively," which had a t-value of -2.2708. All of the 10 top-ranked information technology skills needed by clerical personnel had mean importance ratings equal to or greater than 4.0, indicating "Of above average importance." Teacher mean importance ratings were slightly higher than those of clerical employees for 80 percent (8) of the 10 top-ranked information technology skills needed by clerical personnel. Of the top-ranked skills five were technical, four were human, and one was conceptual.

Managerial. Table 2 reflects the top-ranked information technology skills needed by managerial personnel as rated by managerial employees and teachers. Human Skill Number 4 (H4), "Converse effectively with others," received the highest mean importance rating--4.4000. Significant difference at the .01 level was found for eight of the top-ranked skills. These include Conceptual Skill Number 13 (C13), "Create an effective work environment;" Human Skill Number 7 (H7), "Motivate WP employees;" Conceptual Skill Number 17 (C17), "Establish efficient work flow;" Human Skill Number 9 (H9), "Handle interruptions;" Technical

Table 1

Top-Ranked Information Technology Skills Needed
by Clerical Personnel

Rank		Skill	Skill Classification	Employee Mean (N = 72)	Teacher Mean (N = 70)	t Value	t Probability
1	T16	Follow instructions	Technical	4.7183	4.9000	-2.2329	0.0275*
2	T7	Proofread carefully	Technical	4.7042	4.9000	-1.7327	0.0861
3	H5	Maintain self control under stress	Human	4.6528	4.7246	-0.6245	0.5335
4	H1	Listen effectively	Human	4.6479	4.8551	-2.2708	0.0250*
5	T4	Type with accuracy	Technical	4.6250	4.5857	0.3180	0.7510
6	T2	Keybaord	Technical	4.6143	4.7206	-0.8484	0.3978
7	H4	Accept new training when needed	Human	4.6111	4.7826	-1.8943	0.0605
8	C1	Pricritize documents	Conceptual	4.5915	4.4058	1.1893	0.2364
9	T5	Spell correctly	Technical	4.5694	4.7059	-1.0357	0.3024
10	H3	Ask questions in a clear, concise manner	Human	4.5139	4.7246	-1.8692	0.0643

*Significant at the .05.

Table 2

Top-Ranked Information Technology Skills Needed
by Managerial Personnel

Rank		Skill	Skill Classification	Employee Mean (N = 50)	Teacher Mean (N = 77)	t Value	t Probability
1	H4	Converse effectively with others	Human	4.4400	4.0623	-1.8365	0.0687
2	H6	Promote job satisfaction	Human	4.2000	4.4211	-1.5453	0.1248
3	C13	Create an effective work environment	Conceptual	4.0400	4.4737	-2.7521	0.0068**
4	T3	Read technical information for comprehension	Technical	3.5200	3.9737	-2.4872	0.0142*
5	H7	Motivate WP employees	Human	3.4400	4.1948	-3.2852	0.0015**
6	C17	Establish efficient work flow	Conceptual	3.4200	4.4211	-5.0155	0.0001**
7	H9	Handle interruptions	Human	3.4000	4.1053	-3.6826	0.0003**

Table 2 (continued)

Rank		Skill	Skill Classification	Employee Mean (N = 50)	Teacher Mean (N = 77)	t Value	t Probability
9.5	T2	Manage input/ output data	Technical	3.3600	4.3553	-4.2843	0.0001**
9.5	H3	Orient management and other employees to IT system	Human	3.3600	4.1299	-3.3929	0.0011**
9.5	C11	Evaluate WP employees	Conceptual	3.3600	4.1486	-3.3299	0.0013**
9.5	C19	Prioritize incoming work	Conceptual	3.3600	4.1579	-3.8018	0.0003**

*Significant at the .05 level.

**Significant at the .01 level.

Skill Number 2 (T2), "Manage input/output data;" Human Skill Number 3 (H3), "Orient management and other employees to the IT system;" Conceptual Skill Number 11 (C11), "Evaluate WP employees;" and Conceptual Skill Number 19 (C19), "Prioritize incoming work." Significant difference at the .05 level was found for one skill--Technical Skill Number 3 (T3), "Read technical information for comprehension." Three of the top-ranked information technology skills needed by managerial personnel had mean importance ratings equal to or greater than 4.0 indicating "Of above average importance." All of the top-ranked skills received higher mean importance ratings from teachers than from employees. Five of the top-ranked skills were human, four were conceptual, and two were technical.

Professional. The ten top-ranked information technology skills needed by professional personnel are given in Table 3. Six of the ten were human skills, three were technical skills, and one was a conceptual skill. The skill receiving the highest mean importance rating was Human Skill Number 5 (H5), "Maintain self control under stress." The employee mean importance rating for H5 was 4.7042, and the teacher mean importance rating was 4.4762. Significant difference at the .05 level was found for skill H5; it had a t-value of 2.3561. Significant difference at the .01 level was found for Technical Skill Number 12 (T12), "Proofread carefully;" it had a t-value of -4.2314. All of the 10 top-ranked information technology skills needed by professional personnel had mean importance ratings equal to or greater than 4.0, indicating "Of above average importance." Teacher mean importance ratings were slightly higher than those of professional employees for 60 percent (6) of the 10 top-ranked information technology skills needed by

Table 3

Top-Ranked Information Technology Skills Needed by Professional Personnel

Rank		Skill	Skill Classification	Employee Mean (N = 73)	Teacher Mean (N = 86)	t Value	t Probability
1	H5	Maintain self control under stress	Human	4.7042	4.4762	2.3561	0.0198*
2	H2	Converse effectively with others	Human	4.6986	4.5465	1.4048	0.1620
3	H1	Listen effectively	Human	4.6712	4.7791	-1.2961	0.1968
4	H6	Assume initiative for individual work	Human	4.5833	4.6706	-0.9381	0.3497
5	T3	Compose clear and concise documents	Technical	4.3699	4.5465	-1.2473	0.2141
6	C1	Prioritize work load	Conceptual	4.3611	4.5176	-1.3289	0.1858
7	H4	Handle interruptions	Human	4.2394	4.1412	0.7464	0.4565
8	H7	Appreciate detail	Human	4.1806	4.2381	-0.4166	0.6775

Table 3 (continued)

Rank		Skill	Skill Classification	Employee Mean (N = 73)	Teacher Mean (N = 86)	t Value	t Probability
9	T12	Proofread carefully	Technical	4.0972	4.6744	-4.2314	0.0001**
10	T4	Familiarize self with available information technology equipment	Technical	4.0822	4.0233	0.3901	0.6970

*Significant at the .05 level.

**Significant at the .01 level.

professional employees.

Clerical, managerial, and professional personnel were asked to respond to several questions concerning their individual jobs and work history. Frequency distributions were computed for the demographic data. In addition, analysis of variance and the Scheffe a posteriori test were used to deterine if and where significant differences existed between and among groups.

Clerical Personnel Demographic Data

Employees who use information technology equipment. Of the 43 clerical employees who responded to the items concerning the number of principals who make use of information technology equipment, a range of from 1 - 2,000 users was reported. Fifty-three percent of the respondents served from one to nine principals. Five respondents served from 12 to 14 principals, and six respondents served as many as 275 principals. One person served 2,000 principals.

Number of word processing operators. To the question concerning the number of word processing operators in a company, the numbers ranged from 1-600. The number of word processing operators in 30 companies ranged from one to five. Seven companies reported a total of 16 word processing operators. Two companies reported that they have 87 word processing operators. One company each reported word processing operators in numbers of 7, 12, 30, 50, 100, and 600.

Length of service with the company. Of the 72 respondents to the question relating to length of service with the company, 37, or 51.38 percent, had been employed with the company between one and five years.

Ten, or 13.88 percent, had been employed by the company four years. Distribution of responses is shown as follows:

Years of Service	Number of Employees
1 - 3	21
4 - 6	24
7 - 9	9
10+	18

Time in present position. Of the 72 respondents to the question relating to time in current position, 51 respondents, or 70.83 percent, had been in their current position three years or less. One employee had been in the current position 17 years. Distribution of responses is as follows:

Range	Time in Current Position
0 - 1	24
2 - 3	27
4 - 5	5
6+	7

Education completed. Seventy-one clerical employees responded to the question relating to the amount of formal education completed. Thirty respondents, or 42.25 percent, indicated they had completed a high school education, 33 respondents, or 46.48 percent, indicated they had completed a college education. Only 8 respondents, or 11.27 percent had attended vocational-technical school.

Professionally rewarding work. To the question about whether the current position was professionally rewarding, 58 respondents, or 85.29 percent indicated yes. A negative response was made by nine or 13.24 percent. Five persons, or 1.47 percent, made no response.

Significant difference tests based upon demographic data. Based upon the demographic variable of education, significant differences among employee groups were found at the .05 level for 15 (25 percent) of the 60 skills identified as needed by clerical employees. The skills by category are:

Technical

1. Spell correctly
2. Punctuate carefully
3. Proofread carefully
4. Typeletters
5. Type memos
6. Type reports
7. Type legal documents
8. Type business forms
9. Type company manuals
10. Transcribe machine dictation
11. Transmit documents in house electronically
12. File documents
13. Shutdown information system
14. Code or name material for machine operation or electronic filing

Conceptual

1. Structure new pagination when document is modified

Managerial Personnel Demographic Data

Time in present position. Of the 48 respondents to the question relating to time in present position, 29 (64 percent) indicated that they had been with the company between one and three years. Distribution of responses is shown as follows:

Years	Number of Employees
1 - 3	29
4 - 6	15
7 - 9	4

Formal training received for present position. Forty-nine managers responded to this item on the managerial personnel instrument. Of the forty-nine respondents, 26 (53 percent) indicated that they had completed

a four-year degree program. An additional 19 respondents (38 percent) indicated that they had had graduate education. Therefore, a total of 91 percent of the respondents had four or more years of formal education.

Total time with company. Of the 50 respondents to the item concerning total time spent with present company 31 (62 percent) have been employed by the company between one and ten years. Distribution of the responses is as follows:

Years	Total Time with Company
1 - 5	15
6 - 10	16
11 - 15	5
16 - 20	9
21+	5

Number of subordinates. Subordinates have been identified as those individuals in the word porcessing center who prepare documents using information technology. Forty-seven persons responded to the question concerning the number of subordinates. The range of responses was from 1-70.

Range	Number of Subordinates
1 - 3	17
4 - 6	20
7 - 9	8
10 - 12	1
13 - 15	5
16+	6

Number of principals. Principals have been identified as those individuals who have the responsibility of creating or originating

documents to be prepared by clerical personnel. Thirty-seven managers responded to the question concerning the number of principals served. Twenty (54 percent) indicated the number of principals being served ranging from one to three. However, one company indicated having a center which serves 25 principals. Another center serves 36 principals, and two centers serve 99 principals. The complete distribution of responses is as follows:

Range	Number of Principals
1 - 3	20
4 - 6	6
7 - 9	7
10+	4

Professional Personnel Demographic Data

Time in present position. Seventy-three professionals responded to the question relating to time spent in present position. Forty-eight professional (65.75 percent) had been in their present positions between one and three years. Only four had been with the company in their present positions more than 15 years. Distribution of responses includes:

Years	Number of Employees
1 - 3	48
4 - 6	15
7 - 9	4
10+	6

Formal training received for present position. Seventy-three professional responded to the question relative to the amount of formal training received for their present positions. Of the

seventy-three respondents, 31 (40 percent) indicated that they had completed a four-year degree program. An additional 33 respondents (45.20) percent indicated that they had had graduate education. Therefore, a total of 64 (87.66 percent) of the respondents had had four or more years of formal education.

Total time with the company. Of the seventy-three respondents to the item concerning total time with present company, 40 (54.79 percent) had been with their present employer between one and ten years. However, an additional 24 (27.40 percent) had been with their present employer more than 20 years--one person, 33 years; one person, 36 years; and one person, 37 years. Distribution of theses responses is as follows:

Years	Total Time with Company
1 - 5	24
6 - 10	16
11 - 15	9
16 - 20	15
20+	9

Number of clerical assistants who process work. Sixty-four professionals responded to the question concerning the number of clerical assistants who typically process work for them on an individual basis. Forty-seven respondents (73.43 percent) indicated that their work was typically done by one or two clerical assistants. Ten persons indicated that three different persons typically had the responsibility of completing assigned tasks. Only one individual indicated as many as nine persons had this responsibility.

Work typically completed on word processing equipment. Professionals were asked to respond to a series of classifications of documents to determine work typically completed. Items most frequently prepared were (a) letters, as rated by 66 (92.95 percent) of the respondents; (b) memos, as rated by 66 (92.95 percent); and (c) reports, as rated by 60 (85.71 percent). Business forms and legal documents were rated as documents prepared least often.

FINDINGS

Findings for the parts of the study presented in this paper are as follows:

1. Of the top-ranked information technology skills needed by clerical personnel, five were technical, four were human, and one was conceptual. Of the top-ranked information technology skills needed by managerial personnel, five were human, four were conceptual, and two were technical. Of the top-ranked information technology skills needed by professional personnel, six were human, three were technical, and one was conceptual.

2. H_1 "There are no significant differences in employee and teacher perceptions of information technology skills," was rejected for two of the top-ranked information technology skills needed by clerical personnel, for nine of the top-ranked information technology skills needed by managerial personnel, and for two of the top-ranked information technology skills needed by professional personnel.

3. All of the ten top-ranked information technology skills needed by clerical personnel had mean importance ratings of equal to

or greater than 4.0, indicating "Of above average importance." Three of the top-ranked skills needed managerial personnel had mean importance ratings equal to or greater than 4.0, and all of the ten top-ranked skills needed by professional personnel had mean importance ratings of equal to or greater than 4.0

4. Teacher mean importance ratings were slightly higher than those of clerical employees for 80 percent of the 10 top-ranked information technology skills needed by clerical personnel. All of the top-ranked information technology skills needed by managerial personnel received higher mean importance ratings from teachers than from employees. Teacher mean importance ratings were slightly higher than those of professional employees for 60 percent of the 10 top-ranked information technology skills needed by professional personnel.

5. Based upon the responses to questionnaires concerning demographic questions, the typical clerical information technology worker has the following characteristics:

a. processes information using information technology for from one to nine principals.

b. works in companies which typically employ from one to five word processing operators.

c. has worked for the present company between one and five years and in their current position three years or less

d. finds their current position professionally rewarding.

The educational background of the information technology clerical worker showed approximately half who had completed a high school education and approximately half who hold a bachelor's degree.

6. The demographic data collected from managerial personnel revealed a typical managerial employee with the following characteristics:

   a. has been employed by the present company between one and ten years and in the present position (manager of information technology employees) between one and three years.

   b. has, on the average, between one and six subordinates who process information using information technology for from one to three principals.

The responses concerning the educational background of the managerial personnel was about equally divided between bachelor's and graduate degrees.

7. Based upon the responses to questionnaires concerning demographic questions, the typical professional employee has the following characteristics:

   a. has been with the company either a relatively short time--between one and ten years or over an extended period of time--between 16 and 20 years.

   b. has been in the current position between one and three years.

   c. has work processed by one or two clerical assistants who most frequently prepare letters, memos, and reports.

The educational background of the professional personnel was about equally divided between bachelor's and graduate degrees.

Reference

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